GAS STREAM cleanup
PROJECT

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DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
FEDERAL ENERGY TECHNOLOGY CENTER

HOT GAS DESULFURIZATION PDU PROJECT

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Capabilities

The process development unit (PDU) at FETC will fill the strategic role of bridging the gap between past/current small-scale testing and future large-scale demonstrations. With the capability for both fluid-bed and transport reactor contacting, the project will provide a site for testing/proving hot gas desulfurization (HGD) process configurations and demonstrating sorbent suitability. Process conditions will be representative of anticipated commercial applications in terms of temperatures, pressures, compositions, velocities, and sorbent cycling.

The project utilizes a coupled configuration with continuous circulation of a desulfurization sorbent between the absorption (fuel gas) and regeneration (air) sides of the process. Specially fabricated high-temperature slide valves in the circulation standpipes regulate the flow (circulation) of sorbent between the absorber and regenerator. Inert gases (steam and/or nitrogen) are used to fluidize the sorbent in the standpipes above the valves and to prevent fuel gas and air intermixing. Removable spool pieces and piping along with other vessel design features (such as submerged/freeboard risers and underflow/overflow standpipes) have been incorporated to expand potential testing capabilities. Since both the absorber and regenerator sides have fluid-bed and transport reactor capabilities, four principle configurational modes of operation are possible. Sorbent is circulated by reactant gases (i.e., fuel gas and air) in transport reactor modes and inert gases in fluidized-bed modes.

A natural gas-fired SynGas generator will supply the PDU with high-temperature, high-pressure, simulated coal gasification fuel gas. The simulated coal gas is a mixture of partially-combusted natural gas (H_2, CO, CH_4, etc.) water, carbon dioxide, and hydrogen sulfide.

Opportunities

- Advance/leverage reactor system R&D.
- Share process technology development.
- Qualify sorbent for commercial-scale demonstrations.
- Potential retrofit to applications other than HGD.

FETC

Hot Gas Desulfurization PDU Project

Absorber

Fluid bed: 18 in. i.d. x 10-ft bed
Transport: 5.2 in. i.d. x 50-ft length

Regenerator

Fluid bed: 10 in. i.d. x 12-ft bed
Transport: 1.7 in. i.d. x 50-ft length

Typical Gas Velocity

Fluid bed: 1-3 ft/s
Transport: 15-20 ft/s

(i.d. = inside diameter)

Key Parameters

Absorption temperature	1,000 - 1,200 °F design
Regeneration temperature	1,100 - 1,400 °F design
Operating pressure	400 psia maximum
H_2S concentration	0.5 - 1 vol% typical
Sorbent circulation rate	2,000 - 5,000 lb/hr typical
Sorbent inventory	1,000 - 2,000 lb typical
Sorbent cycles per day	50 - 100 typical
Sorbent size	50 - 300 µm typical
Fuel gas flow rate	60,000 - 120,000 scf/h typical

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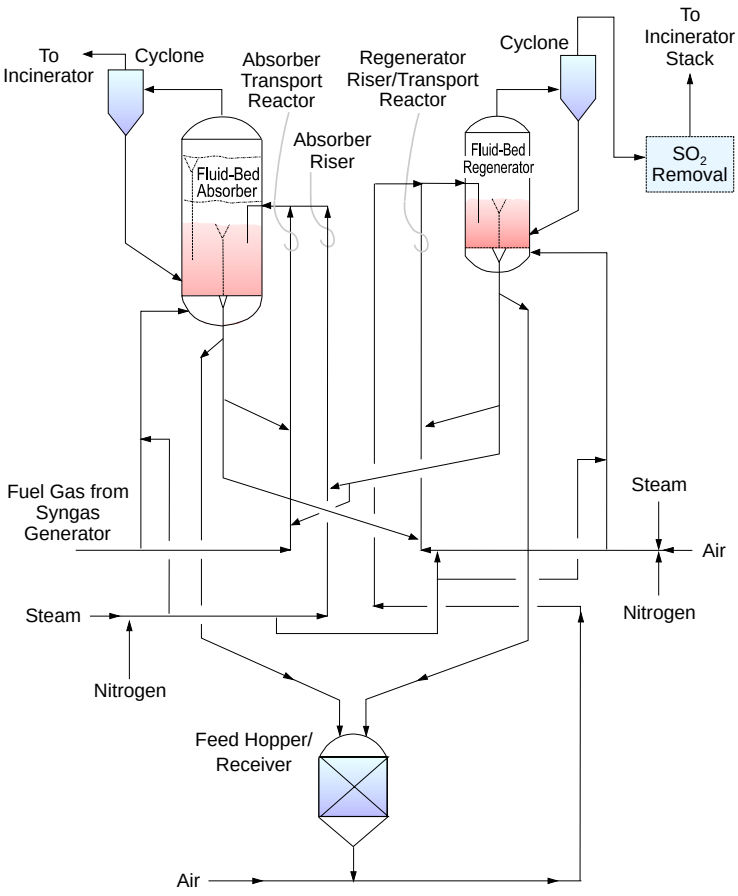
PDU Flow Diagram



Note: Only major interconnections shown

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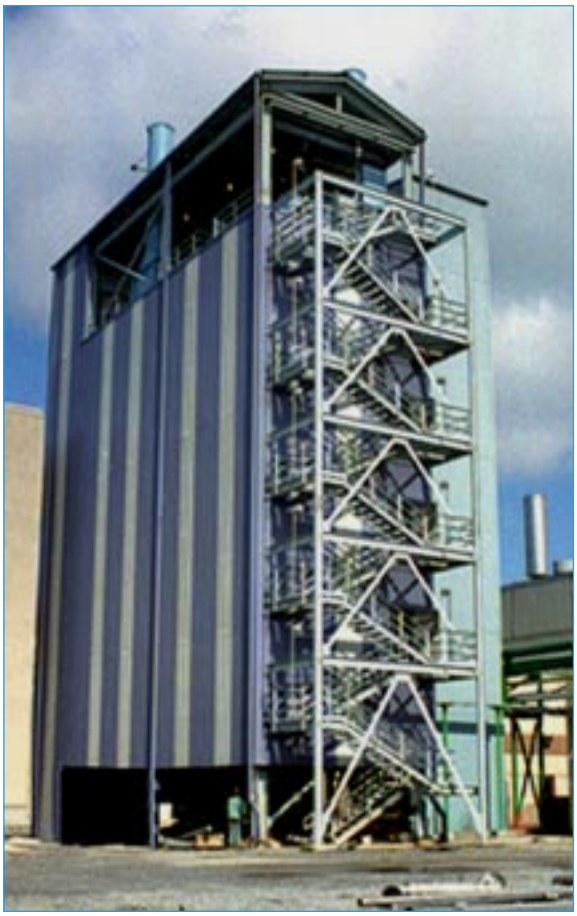

The PDU at FETC

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